4.0 WTD Existing Discharges Area

The following section provides known information regarding habitat distribution and usage of the various habitats in the WTD Existing Discharges Area by the species covered in this report (listed in Section 2.0). Readily known distribution and relative abundance information for the covered species in the WTD Existing Discharges Area are also provided. Data gaps are identified in this section where appropriate; however, a detailed discussion regarding data gaps is provided in Section 6.0.

As stated in Section 3.0, a comprehensive examination of physical oceanographic characteristics in the WTD Existing Discharges Area is beyond the scope of this report but is available in a separate document (Ebbesmeyer and Cannon 2000). Water and sediment chemistry data in the WTD Area are also beyond the scope of this report but are available in the documents listed in Section 3.0.

4.1 Physical Setting

The WTD Existing Discharges Area (Area 2) extends from the King/Snohomish County boundary in the north to the northern tip of Vashon Island in the south, including Elliott Bay (see Figure 1-1). There is some overlap with the Brightwater Outfall Siting Area from Golden Gardens north to the county boundary. There are diverse habitats in the area, including sand and gravel beaches, stream mouths, two major freshwater inputs (Lake Washington Ship Canal and Duwamish River), and an urbanized embayment (Elliott Bay). In the northern portion of the area, the supralittoral area (>3 m MLLW) supports the bed and tracks of the Northern Pacific Railroad. Shilshole Bay is located to the north of West Point and the supralittoral zone in this area is highly developed with a marina and several restaurants. The King County West Point Wastewater Treatment Plant is located above the supralittoral zone at West Point; and the steep bluffs above Magnolia bound the supralittoral from West Point to Smith Cove (Elliott Bay Marina). Inner Elliott Bay (which includes the Seattle waterfront) and the Duwamish estuary are heavily urbanized with riprap, docks and piers. The south side of Elliott Bay, from Duwamish Head to the lower part of the WTD Existing Discharges Area, is mostly bulkheaded and residential in nature. The deepest water depth in the WTD Existing Discharges Area is approximately 243 m just north of West Point. Figure 4-1 provides information regarding slopes and depths of the seafloor in the WTD Existing Discharges Area.

4.2 Habitat Distribution

In this section, the general distributions of the major habitats are presented. Some information is also provided on the types of fauna associated with these habitats (e.g., eelgrass). The habitats are discussed under three subheadings: supralittoral, intertidal and shallow subtidal, and finally the deep subtidal. For more information on the types of fauna associated with these habitats see Section 2.6.

4.2.1 Supralittoral

Seawall or other shoreline armoring structures (Figure 4-2) predominantly border the shoreline in the WTD Existing Discharges Area. There are likely areas of overhanging vegetation in some of the areas bordered by seawalls. There is a small amount of treed shoreline at West Point. The seawalls and shoreline armoring in this area, as previously mentioned in Section 3.2.1, have had influences on the benthic community (Williams and Thom, in prep). Seawalls have most likely reduced the intertidal zone and soft bottom communities, increasing the rocky shore communities and their associated habitats.

4.2.2 Intertidal through Shallow Subtidal

The intertidal and shallow subtidal zones in the WTD Existing Discharges Area contain all major habitat types typically found in central Puget Sound (e.g., eelgrass meadows, kelp forests, flats, tidal marshes, and subestuaries). However, there is considerable alteration of habitats through shoreline armoring, dock structures, removal of riparian habitat, and dredging and filling. In particular, the Duwamish River estuary and Elliott Bay are heavily altered. Very little of the original natural habitats remain in these areas.

Intertidal and shallow subtidal substrates in the WTD Existing Discharges Area are composed primarily of various grades of sand with a mix of gravel, cobble, and small rocks. The breakwater protecting the Shilshole Marina rests in about 20 m of water and provides a hard substrate with crevices for many types of invertebrates (such as crabs, shrimp, barnacles, snails, and limpets) and fish (such as sculpins, greenlings, and gunnels). The breakwater also provides substrate for many types of marine vegetation, which are discussed in detail below. In inner Elliott Bay, substrates are the same as in other parts of the area; however, the sand contains an even mix of sand and silt caused by fine particulate material from the Duwamish River.

The distributions of some of the major vegetation taxa used to depict the nearshore habitats in the WTD Existing Discharges Area are shown in Figures 4-3 through 4-9.

Fucus sp. is common but patchy. It forms dense continuous beds along the breakwater at Shilshole Marina and along rocky shorelines in Elliott Bay (Figure 4-3). *Ulva* spp. is found very frequently along the shoreline of the WTD Existing Discharges Area (Figure 4-4). It occurs primarily in patches but is also found in continuous beds. It is within these exposed and semi-exposed rocky habitats that wide a variety of species are found. Examples of species covered in this report found within these habitats include coho salmon, cutthroat trout, Dolly Varden, and river lamprey (Simenstad et. al. 1991).

Laminaria spp. is common but patchy throughout most of the region (Figure 4-5) and is closely associated with the *Fucus* sp. shown in Figure 4-3. Kelp, based on the WDNR Shorezone Database (WDNR 1999) and the 1999 surveys conducted by Battelle Marine Sciences Laboratory for King County (Woodruff et al. 2000), is common but patchy in the region (see Figures 4-6 and 3-7).

Eelgrass is very common but patchy over most of the area (Figures 4-7 and 3-7). The presence of eelgrass would indicate that, as that in Section 3.2.2, sediment types are finer grained. As stated in Section 3.2.2, eelgrass serves as habitat for many different species and provides different functions for these species (Simenstad et. al 1991).

Like the Brightwater Outfall Siting Area, tideflats are common in the WTD Existing Discharges Area but have not been mapped completely. One tideflat in the Area that has received scientific study is at Alki beach (Armstrong et al. 1976; Stober and Chew 1984; Thom and Albright 1990). The infaunal communities in the WTD Existing Discharges Area are an important source of zooplankton, crustaceans, and amphipod species to juvenile salmonid diets (see Appendix A). These tideflats are productive areas for microalgae and serve as important feeding habitat for juvenile chinook and chum salmon (Thom et al. 1984; Simenstad et al 1991).

4.2.3 Deep Subtidal

The deep subtidal zone in the WTD Existing Discharges Area has been extensively studied since the late 1970s, especially in the southern portion of the area. Thom et al. (1979) sampled 121 stations along 20 transects from West Point to Three Tree Point. Ten transects were clustered around West Point with five stations along each transect. The remaining 71 stations were located along nine transects spread throughout the area from West Point to Three Tree Point. The King County (formerly know as METRO) Toxicant Pretreatment Planning Study (TPPS) program (Commiskey et al. 1984) sampled 71 stations along 18 transects from West Point to inner Elliott Bay. The Duwamish Head Baseline Study (Word et al. 1984b) sampled 83 stations along 18 transects. Eighteen of the 132 stations sampled as part of the Seahurst Baseline Study (Word et al. 1984a) were located in the WTD Existing Discharge Area. The results of the Duwamish Head and Seahurst studies show that along the shelf, with the

exception of inner Elliott Bay, the primary habitat consisted of coarse to medium sand.

The transition between the shelf and slope portions of the deep subtidal is not as evident in the WTD Existing Discharges Area compared to the Brightwater and Vashon Island Areas. The substrate along the shelf grades from sand to sandy-silt as the depth of the water increases. Rocky outcropping can be found at the shelf/slope break and there is an abandoned dredged material disposal site off Magnolia Bluff adjacent to Four Mile Rock. The habitat in the central deep basin is characterized primarily by soft silt and clay except at the immediate base of West and Alki Points. The habitats off these two points contain a greater portion of sand. The deep subtidal in inner Elliott Bay also consists of silts and clays except at the location of the confined open water dredged material disposal site in the middle of the bay.

The dominant organisms were similar to what was seen in the Brightwater Outfall Siting Area, although in less abundance. These included the polychaete *Phyllochaetopterus prolifica*, the bivalve molluscs *Psephedia lordi* and *Megacrenella columbiana*, and the ostracod *Euphilomedes carcharodonta*. The habitats along the eastern shelf of inner Elliott Bay contained a mix of fine sand and silt. The dominant organisms in this area tended to be pollution-tolerant species. Their presence indicated that the sediments in the region were becoming organically enriched. Dominant organisms included the polychaetes *Capitella capitata*, *Aphelochaeta* spp., and *Notomastus tenuis*. Dominant bivalve molluscs included *Macoma carlottensis* and *Axinopsida serricata*. The dominant crustaceans were *Euphilomedes carcharodonta* and *Euphilomedes producta*.

4.3 Species Distribution and Occurrence

The distribution and occurrence information presented below for the proposed HCP species is based upon documented information cited in available literature and/or personal communication with biologists/experts from local, state, and federal agencies. Much of the distribution data for fishes are based upon trawl and video data and are dependent upon time of year, depth, and location sampled. Many pelagic fish, such as yellowtail and black rockfish, are rarely documented in trawl surveys as the sampling method favors capturing semi-demersal or demersal fish such as lingcod, Pacific cod, and quillback rockfish. The absence of pelagic and other species for trawl and video data does not preclude those species from inhabiting waters in the WTD Existing Discharges Area. The majority of data for marine birds are based upon seasonal aerial and land surveys and are dependent upon favorable sighting conditions, time of year surveyed, species wariness, and location surveyed.

4.3.1 Marine Mammals and Birds

Orca – *Orcinus orca*

Of the three resident Puget Sound Orca pods, the J pod is most likely to be observed in the WTD Existing Discharges Area. The whales follow seasonal salmon runs with yearly sightings clustered from June through October (Balcomb 1982; Olesiuk et al. 1990). For example, groups of 16-17 whales have been sighted off Alki Point in October and groups of 16-17 whales have also been sighted off Point Jefferson in September (Balcomb and Goebal 1976). In recent years, the J pod has been observed in the WTD Existing Discharges Area off West Seattle and West Point during the fall months, following the salmon runs (K. Koski, Whale Museum, pers. comm.). Transient whales are not known to occur in inland Puget Sound waters (Forney et al. 2000).

Harbor Porpoise – *Phocoena phocoena*

There have been no confirmed sightings of harbor porpoises south of Admiralty Inlet (including the WTD Existing Discharges Area) during the last several years (Calambokidis et al. 1992; B. Hanson, NMML, pers. comm.). A survey during favorable sighting conditions in 1996 found no harbor porpoises in Puget Sound (Osmek et al. 1997).

Steller Sea Lion – *Eumetopias jubatus*

Steller sea lions are found in small numbers in the inland waters of Puget Sound. Documented sightings in central Puget Sound have been in the WTD Existing Discharges Area, including sightings near tribal fishing nets in Elliott Bay and the Duwamish River between October and January (Chumbley 1993; Gearin at al. 1988). Steller sea lions have also been seen near or on navigational buoys and the National Marine Fisheries Service/National Marine Mammal Laboratory sea lion trap in Shilshole Bay in small numbers (1-2 individuals) (M. Lance, WDFW, pers. comm.).

Common Murre – *Uria aalge*

WDFW (2000) reported that from 1992 through 1999 the number of common murres in the WTD Existing Discharges Area in the winter ranged from 0 to 5 animals/km^2 (Figure 3-8). In the summer months, the average number of common murres also ranged from 0 to 5 animals/km^2; however, there were more areas with no sightings than in the winter months (Figure 3-9). Murres have been seen every year during the Seattle CBC annual survey since 1983, with numbers ranging from 7 to 225 birds (H. Opperman, Seattle Audubon Society, pers. comm.).

Marbled Murrelet – *Brachyramphus marmoratus*

Marbled murrelets have shown a gradual decline over recent years and have been seen in the WTD Existing Discharges Area only during 8 of the last 17 yearly Seattle CBC Surveys. The number of murrelets observed ranged from 1 to 17,

but usually only 1 to 3 birds were noted when this species was present (H. Opperman, Seattle Audubon Society, pers. comm.). WDFW (2000) reported no marbled murrelets in the WTD Existing Discharges Area during winter surveys from 1992 through 1999 (Figure 3-10). In the summer months, 1 to 2 birds were observed in the area (Figure 3-11).

Harlequin Duck – *Histrionicus histrionicus*

WDFW (2000) found that from 1992 through 1999 the number of harlequin ducks in the WTD Existing Discharges Area in the winter ranged from 0 to 24 animals/km^2 (Figure 3-12). In the summer months, no harlequin ducks were observed in the area (Figure 3-13) Harlequin ducks have been seen in the WTD Existing Discharges Area every year since 1983 during the Seattle CBC annual survey. The counts ranged from 18 to 59 birds (H. Opperman, Seattle Audubon Society, pers. comm.).

4.3.2 Salmonids

Bull Trout – *Salvelinus confluentus*

The distribution and abundance of bull trout in Puget Sound, including nearshore waters is not well understood. Populations of bull trout have been documented in rivers and streams that enter the nearshore waters of the WTD Existing Discharges Area. Isolated observations of bull trout have been made during the last decade at the mouth of the Duwamish River estuary and seaward of the Lake Washington Ship Canal (King County 2000a). Miller and Borton (1980) documented Dolly Varden at the mouth of the Lake Washington Ship Canal and around Shilshole Bay (see Figure B-12, Appendix B). As Dolly Varden are closely related to bull trout and it is difficult to distinguish the two species without genetic testing, it is possible that these fish were bull trout. Approximately eight adult bull trout were captured in Shilshole Bay/Lake Washington Ship Canal in Spring 2000 and seven were captured in the Turning Basin region of the Duwamish River in September 2000 (B. Mavros, King County, pers. comm.).

Chinook Salmon – *Oncorhynchus tshawytscha*

In the WTD Existing Discharges Area, a number of site-specific studies have been conducted since the early 1980's on juvenile chinook abundance, feeding, and residence time in the Duwamish River estuary (Parametrix 1980, 1982, 1983, 1984, Meyer et al. 1981). Densities in the Duwamish River estuary ranged from less than 1 to 266 per 30.5 m (net length) beach seine haul (Meyer et al. 1981) to 270 per 37 m beach seine hauls (Taylor et al. 1999). Greatest densities have been reported over shallow, sloping, relatively soft mud beaches. Purse seine samples, which sample the water column in deep areas, captured 19 times fewer juvenile chinooks than beach seine samples from shallow shoreline areas in the Duwamish River. Density peaked in mid-May to early June following hatchery plants upstream. Juvenile chinook have also been caught by beach seines and

purse seines in Smith Cove, located at the north end of Elliott Bay (Taylor et al. 1999). Densities in this area have been comparable to those in the main part of the Duwamish estuary. Preliminary results from 1998 sampling indicate that juvenile chinook salmon were the second most abundant salmon species preceded by chum salmon (Taylor et al. 1999).

King County conducted beach-seining surveys in the southern portion of the WTD Existing Discharges Area at Fauntleroy from June to August 2000. Juvenile chinook (less than fifteen) were observed in June and July but none were seen in August (Mavros and Brennan, in prep.). Miller and Borton (1980) reported observations of chinook salmon within most sections of the WTD Existing Discharges Area, but abundance data were not reported (see Figure B-9, Appendix B). Beach seine surveys conducted off of West Point and Alki Point in 1975 and 1976 reported chinook salmon numbers of 24 and 34, respectively (Stober and Pierson 1984).

WDFW reported 1995 sport catch data for chinook salmon in an area that included all the WTD Existing Discharges Area, Bainbridge Island, and Bremerton. Over 13,000 chinook salmon were caught in this area, mainly in August. However, these data do not distinguish between hatchery and wild salmon (Manning et al. 1999).

WDFW (1993) documented populations of summer and fall chinook in streams and rivers within the WTD Existing Discharges Area. Adult chinook salmon return to these rivers to spawn and will be found in the marine waters surrounding the area. Adults tend to stay in shallow nearshore areas before entering natal rivers and streams (Stober and Pierson 1984). Abundance data from WDFW (1993) was based upon the number of fish that survived natural and fisheries impacts (escapements) to make up a spawning population in rivers or streams. The number of escapements in this survey represented a larger population of adult fish returning to the waters of the WTD Existing Discharges Area than previously documented. The escapements for Issaquah and East Fork Issaquah creeks were up to 5,000 individuals, with spawning of a native stock with wild production in late September through October. The escapement was unknown for the tributaries of North Lake Washington creeks with native spawners returning in September through October. The Cedar River supported a native stock with wild production with an escapement of up to 4,300 individuals. The healthy Duwamish/Green River population spawned from September through October with an escapement of up to 11,500 individuals from a mixed stock of composite production. Newaukum Creek also supported a mixed stock with up to 3,000 escapements (WDFW 1993b).

Additional data available for the Green River showed postseason abundance estimates of summer/fall chinook stock at 17,781, 12,545, and 17,131 individuals in 1992, 1993, and 1994, respectively (PFMC 1997). These abundance estimates include estimated net catch, sport catch, and escapements.

Chum Salmon – *Oncorhynchus keta*

Site-specific studies in the WTD Existing Discharges Area on juvenile chum abundance, feeding, and residence time have been conducted in the Duwamish River estuary since the early 1980's. Densities in the Duwamish River estuary ranged from less than 1 to more than 300 individuals per 30.5 m beach seine haul (Meyer et al. 1981). The period of peak chum salmon abundance was between March and April. Very few chum have been collected in purse seines offshore of the beach seine sites. In 1998 at Smith Cove, densities of juvenile chum salmon have been reported up to 438 individuals per 37 m beach seine haul (Taylor et al. 1999). King County conducted beach-seining surveys at Fauntleroy from June to August 2000, where juvenile chum (less than five) were observed only in June (Mavros and Brennan, in prep.).

Adult chum salmon were found within the WTD Existing Discharges Area prior to 1973 (Miller and Borton 1980). Observations were clustered around the waterways to Lake Washington and in Elliott Bay and the Duwamish Waterway (see Figure B-6, Appendix B). Although distribution data were presented in this data set, abundance data were not available. Beach seine surveys conducted off of West Point and Alki Point in 1975 and 1976 reported chum salmon numbers of 92 and 41, respectively (Stober and Pierson 1984).

WDFW reported 1995 sport catch data for chum salmon in an area that included all the WTD Existing Discharges Area, Bainbridge Island, and Bremerton. Just over 600 chum salmon were caught in this area from September to January; however, these data did not distinguish between hatchery and wild salmon (Manning et al. 1999).

The 1992 SASSI report documented populations of fall chum in streams and/or rivers within the WTD Existing Discharges Area (WDFW 1993b). The marine waters of this area are utilized by adult chum salmon as they return to these rivers to spawn. Adults use nearshore areas to mill prior to river and stream entry (Stober and Pierson 1984). The SASSI report confirmed that Duwamish/Green River waters support populations of chum salmon. The escapements for Duwamish/Green River were unknown and the status of these fall spawners (a mixed stock of composite production) was also unknown (WDFW 1993b).

Coho Salmon – *Oncorhynchus kisutch*

In the early 1980's in the WTD Existing Discharges Area, coho salmon smolts were collected by beach seines in tidal channels of the Duwamish River and densities were generally low (Parametrix 1980, 1982, 1983, 1984, Meyer et al. 1981). These relatively low densities peaked in early May to early June corresponding to coho salmon released at the Soos Creek hatchery (Meyer et al. 1981). Coho smolts have been caught in Elliott Bay in beach and purse seines, with numbers ranging from 1 to 413 coho per seine set (Parametrix 1980). For the beach seining surveys conducted by King County in the WTD Existing Discharges Area at Fauntleroy from June to August 2000, juvenile coho (less

than five) were observed in June and August and none were observed in July (Mavros and Brennan, in prep).

Miller and Borton (1980) reported adult coho salmon throughout the WTD Existing Discharges Area. Observations were reported throughout the waters leading to Lake Washington and through Elliott Bay and the Duwamish Waterway (see Figure B-7, Appendix B). Beach seine surveys conducted off of West Point and Alki Point in 1975 and 1976 reported coho salmon numbers of 168 and 25, respectively (Stober and Pierson 1984).

WDFW reported 1995 sport catch data for coho salmon in an area that includes all the WTD Existing Discharges Area, Bainbridge Island, and Bremerton. Almost 14,000 coho salmon were caught, primarily in September, in this area. However, these data do not distinguish between hatchery and wild salmon (Manning et al. 1999). WDFW (1993) reported that Lake Washington/Sammamish tributaries and the Duwamish/Green River had populations of coho salmon. The Lake Washington/Sammamish tributaries stock was listed as depressed by WDFW, with unknown escapements of these late October through mid-December spawners. The Cedar River escapements of late October through early March spawners were reported as unknown, but the status was considered healthy. The Green River/Soos Creek escapements were up to 12,500 fish, with spawning from late October through mid-December for this healthy mixed stock. The Green River/Newaukum Creek stock was listed as depressed, with unknown escapements for these late October through mid-January spawners.

Cutthroat trout – Oncorhynchus clarki

A compilation of distribution data for Puget Sound fishes through 1973 showed very few observations of cutthroat trout within the WTD Existing Discharges Area (Miller and Borton 1980). The noted observations were in nearshore waters near the mouth of the waterways leading to Lake Washington (see Figure B-10, Appendix B). Juvenile cutthroat trout (less than five) were observed in June during beach seining surveys conducted by King County in the WTD Existing Discharges Area at Fauntleroy from June to August 2000. None were observed in July or August (Mavros and Brennan, in prep).

Although the status of most Puget Sound cutthroat trout populations is unknown, cutthroat trout do occur in drainages in the WTD Existing Discharges Area, including the Lake Washington and Cedar River watersheds (Johnson et al. 1999). Cutthroat trout migrating to streams and rivers use nearshore estuarine waters in the area for food and shelter.

Sockeye salmon – *Oncorhynchus nerka*

When data for Puget Sound fishes through 1973 was compiled by Miller and Borton (1980), sockeye salmon were reported in waters leading to Lake Washington (see Figure B-8, Appendix B). Sockeye were not found south of the vicinity of Lake Washington waterways. The number of sockeye escapements in

the Cedar River was estimated by WDFW (1993) to be between 76,000 and 365,000 individuals for the years 1967 to 1991. The sockeye population spawning in the Cedar River is the largest sockeye population in the contiguous United States (Gustafson et al. 1997). The Lake Washington/Sammamish Tributaries escapements ranged from 3,600 to 29,700 individuals from 1982 through 1991. The number of Lake Washington beach spawners ranged from 54 to 1032 during the years 1984 through 1992 (WDFW 1993b). Beach seining surveys conducted by King County in the WTD Existing Discharges Area at Fauntleroy from June to August 2000 found juvenile sockeye (less than five) in June only (Mavros and Brennan, in prep).

Manning et al. (1999) reported 1995 sport catch data for sockeye salmon in an area that includes all the WTD Existing Discharges Area, Bainbridge Island, and Bremerton. Only eight sockeye salmon were caught in September in this area.

Steelhead – *Oncorhynchus mykiss*

Steelhead were found within the WTD Existing Discharge Area when data for Puget Sound fishes through 1973 were compiled but no abundance data were reported (Miller and Borton 1980). The observations were clustered around the waterways to Lake Washington and in Elliott Bay and the Duwamish Waterway (see Figure B-11, Appendix B). Juvenile steelhead (less than five) were only observed in June at Fauntleroy during beach seining surveys conducted by King County in the WTD Existing Discharges Area from June to August 2000 (Mavros and Brennan, in prep).

There are known winter-run steelhead populations in the Green, Puyallup, and Nisqually Rivers and summer-run populations in the Green River (Pauley et al. 1986). Steelhead migrating to the Green River, and likely those fish migrating to south sound rivers, travel through marine waters in the WTD Existing Discharges Area.

4.3.3 Lamprey

Pacific Lamprey (*Entosphenus tridentatus*) and River Lamprey (*Lampetra ayresi*)

There is very little distribution and abundance data for lampreys in Puget Sound. Wydoski and Whitney (1979) noted that a newly metamorphosed Pacific lamprey was found in Lake Washington in the 1970's. Stober and Pierson (1984) documented a river lamprey in the lower Duwamish River and Miller and Borton (1980) noted two occurrences in Elliot Bay (see Figure B-2, Appendix B). No other distribution information was readily available.

4.3.4 Invertebrates

Northern Abalone (*Haliotis kamtschatkana*) and Olympia Oyster (*Ostrea conchaphila*)

There were no documented occurrences of either the northern abalone or the Olympia oyster in the WTD Existing Discharges Area. As stated in Section 3.3.4, the northern abalone is generally not found in estuaries and is primarily found on the outer coast and in the Straits (Sloan and Breen 1988). Although it is possible that isolated occurrences of Olympia oysters may be found in the WTD Existing Discharges Area, the numbers are not enough to sustain a breeding population as water temperatures in the Area are colder than spawning requirements (Couch and Hassler 1989) (see Section 3.3.4).

4.3.5 Marine Fish

Of the 24 species of marine fishes addressed in this report, eight were observed and identified in the WTD Existing Discharges Area by WDFW video and trawl surveys (Figure 4-8). In addition, the WDFW Technical Report No. 79 identifies known forage fish spawning grounds in the WTD Existing Discharge Area (Figure 4-9) (WDFW 1992).

The marine fish proposed for coverage in this report are listed in Table 4-1 along with their distribution range, primary habitat on which they were most often observed, the depth range at which they were observed, and their relative abundance within the WTD Existing Discharges Area. As stated in Section 3.3.5, the fact that a species was not observed does not mean that it was not present. These species are mobile and many tend to hide in cracks and crevices. In addition, many have cryptic coloration making them difficult or impossible to see even when they are in the open. Seasonal variation in food resources, life history stages (e.g., spawning, juvenile recruitment), or environmental conditions can also affect the presence, distribution, and abundance of fish species.

Ground Fish

Green (*Acipenser medirostris*) and White (*Acipenser transmontanus*) Sturgeon

There were no documented records of green sturgeon in the WTD Existing Discharges Area, but Miller and Borton (1980) did report two records of green sturgeon occurrences somewhere within Puget Sound (the specific locations were not noted). There are two records of a white sturgeon seen in the WTD Existing Discharges Area. Miller and Borton (1980) reported a white sturgeon near Duwamish Head and DeLacy and Borton (1972) reported a white sturgeon in the Seattle area (see Figure B-4, Appendix B).

Pacific Cod – *Gadus macrocephalus*

Miller and Borton (1980) reported observations of Pacific cod throughout the WTD Existing Discharges Area, particularly in Elliott Bay and from West Point

north to the county line (see Figure B-15, Appendix B). During 1975-76 beach seine and otter trawl surveys, a single Pacific cod was caught off West Point at a depth of 25 m, 17 were caught off Alki Point at depths from 37 to 45 m, and 1 was caught in the lower Duwamish River (Stober and Pierson 1984). Two additional Pacific cod were caught in eelgrass off Alki Point during 1976-77 beach seine surveys (Stober and Pierson 1984). For the Stober and Pierson surveys, Pacific cod was one of the most abundant species found along the pilings and riprap surrounding Piers 90 and 91 in Elliott Bay (Stober and Pierson 1984). WDFW trawl survey data documented Pacific cod throughout the WTD Existing Discharges Area in both nearshore and offshore waters (Figure 4-8 and Appendix C).

Walleye Pollock – *Theragra chalcogramma*

Miller and Borton (1980) reported observations of walleye pollock throughout the WTD Existing Discharges Area (see Figure B-17, Appendix B). During 1975-1976 beach seine and otter trawl surveys, 18 walleye pollock were caught off West Point from depths up to 95 m and 47 were caught off Alki Point at depths up to 70 m (Stober and Pierson 1984). Four additional walleye pollock were caught in eelgrass off Alki Point during 1976-77 beach seine surveys (Stober and Pierson 1984). Stober and Pierson (1984) noted that walleye pollock were associated with pilings and riprap at depths between 11 and 18 m near Terminal 37 in the Duwamish River (Stober and Pierson 1984). WDFW trawl data shows pollock throughout the WTD Existing Discharges Area from north to south but does not show this species occurring in shallow nearshore waters (see Figure 4-8 and Appendix C).

Pacific Hake – *Merluccius productus*

Miller and Borton (1980) reported observations of Pacific hake throughout the area north of Alki Point to the northern limit of the WTD Existing Discharges Area (see Figure B-16, Appendix B). During 1975-76 beach seine and otter trawl surveys, a single Pacific hake was caught off West Point at a depth of 95 m and three were caught off Alki Point at a depth of 70 m (Stober and Pierson 1984). WDFW trawl data indicated Pacific hake throughout the WTD Existing Discharges Area from north to south but did not show this species occurring in shallow nearshore waters (Figure 4-8 and Appendix C). However, Pacific hake are seasonally abundant in nearshore waters (less than 21 m) in Elliott Bay (J. Christiansen, Seattle Aquarium, pers. comm.).

Lingcod – *Ophiodon elongates*

Miller and Borton (1980) reported observations of lingcod throughout the WTD Existing Discharges Area from Alki Point to north of Meadow Point (see Figure B-33, Appendix B). WDFW trawl survey data showed lingcod in the WTD Existing Discharges Area near Magnolia and video survey data showed lingcod at two inner Elliott Bay locations (see Figure 4-8 and Appendix C). All observations were in nearshore waters less than 17 m.

Forage Fish

Pacific Herring – *Clupea harengus pallasi*

Miller and Borton (1980) reported observations of Pacific herring throughout the WTD Existing Discharges Area, especially near Elliott Bay (see Figure B-5, Appendix B). WDFW trawl data document herring from inner Elliott Bay to the northern boundary of the WTD Existing Discharges Area (Figure 4-8 and Appendix C). Quinnell and Schmitt (1991) found Pacific herring most abundant in shallow water (9-37 m) and estimated an abundance of nearly 1.5 million individuals in the central Puget Sound area in 1987.

While there are no documented Pacific herring spawning grounds within the WTD Existing Discharges Area, spawning grounds are documented to the south (Quartermaster Harbor), west (Port Orchard/Madison), and north (Port Susan) (Figure 4-9) (Lemberg et al. 1997). It is probable that Pacific herring of all ages pass through the WTD Existing Discharges Area on their way to or from the spawning grounds, especially during spawning season (late January through early June).

Sand Lance – *Ammodytes hexapterus*

Miller and Borton (1980) reported sand lance between Alki Point and Duwamish Head, lower Duwamish River, and from West Point north to the county line (see Figure B-18, Appendix B). During 1975-76 beach seine surveys, 247 sand lance were caught off West Point, while 1,250 sand lance were caught in eelgrass off Alki Point during 1976-77 surveys (Stober and Pierson 1984). King County conducted beach-seining surveys in the southern portion of the WTD Existing Discharges Area at Fauntleroy from June to August 2000. Sand lance were seen in abundance in June and July, with over 1,000 documented in July. None were seen in August (Mavros and Brennan, in prep).

Figure 4-9 shows documented sand lance spawning grounds in the WTD Existing Discharges Area. These areas are located on the north side of Alki Point, Fauntleroy cove, and at Golden Gardens (WDFW 1992). The area from Alki Point south to the southern boundary of the WTD Existing Discharges Area has been extensively surveyed for forage fish spawning habitat. However, the remaining WTD Existing Discharges Area has not been thoroughly surveyed and it is possible there are additional sand lance spawning grounds in this area (Penttila 2000).

Surf Smelt – *Hypomesus pretiosus*

Miller and Borton (1980) reported observations of surf smelt near Alki Point, the mouth of the Duwamish River, and from West Point north to Richmond Beach (see Figure B-13, Appendix B). Stober and Pierson (1984) observed surf smelt in shallow water around eelgrass and sandy bottoms at Alki Point and West Point.

Figure 4-9 shows documented surf smelt spawning grounds in the WTD Existing Discharges Area. These spawning areas are located just north of Fauntleroy, the

north side of Alki Point, and just south of Richmond Beach (WDFW 1992). As with sand lance, the area from Smith Cove north to the northern boundary of the WTD Existing Discharges Area has not been thoroughly surveyed and it is possible there are additional surf smelt spawning grounds in this area (Penttila 2000).

Eulachon – *Thaleichthys pacificus*

There was little information available regarding distribution of eulachon in the WTD Existing Discharges Area. Miller and Borton (1980) reported three observations of eulachon near Golden Gardens and Carkeek (see Figure B-14, Appendix B) and Stober and Pierson (1984) reported two eulachon in the lower Duwamish River during 1975-76 surveys. This is considered a rare species in Puget Sound (Emmett et al. 1991).

Rockfish

The following rockfish species proposed for coverage in the HCP are distributed along the outer Washington coasts and in the Straits surrounding the San Juan Islands but are not known to occur in inland Puget Sound waters or in the WTD Existing Discharge Area: blue, widow, china, and tiger rockfish (W. Palsson, WDFW, pers. comm.; J. Christiansen, Seattle Aquarium, pers. comm.).

Figure 4-9 shows an area in the southwestern portion of the WTD Existing Discharges Area (between Vashon Island and Blake Island) where reef-dwelling bottom fish are known to occur (WDFW 1992). Although individual species are not included in this data set, it is probable that some of the rockfish species proposed for coverage in the HCP are found in this area. Other rockfish species covered in this report are discussed below.

Brown Rockfish – *Sebastes auriculatus*

Miller and Borton (1980) reported brown rockfish from Meadow Point to West Point, Elliot Bay, and Alki Point (see Figure B-19, Appendix B). During 1975-76 beach seine and otter trawl surveys, 56 brown rockfish were caught off West Point at depths between 25 and 95 m and 31 were caught off Alki Point at depths up to 70 m (Stober and Pierson 1984). Two brown rockfish were caught in eelgrass off Alki Point during 1976-77 beach seine surveys (Stober and Pierson 1984). Brown rockfish were also observed near Piers 91 and 90 and Terminal 37 in Elliott Bay and the lower Duwamish River (Stober and Pierson 1984). Brown rockfish were seen from West Seattle north to Shilshole Bay, including inner Elliott Bay, during WDFW video surveys (Figure 4-8 and Appendix C). All occurrences were in nearshore waters.

Copper Rockfish – *Sebastes caurinus*

Miller and Borton (1980) reported copper rockfish throughout the WTD Existing Discharges Area (see Figure B-20, Appendix B). During 1975-76 beach seine and otter trawl surveys, two copper rockfish were caught off West Point at depths of 25 and 45 m and three were caught off Alki Point in shallow water (Stober and

Pierson 1984). Copper rockfish were also observed near Piers 91 and 90 and Terminal 37 in Elliott Bay and the Duwamish River (Stober and Pierson 1984). WDFW video surveys documented copper rockfish from the southern portion of the WTD Existing Discharges Area north to Shilshole Bay (Figure 4-8 and Appendix C). All occurrences were in relatively shallow waters (less than 24 m).

Greenstriped Rockfish – *Sebastes elongates*

Miller and Borton (1980) reported greenstriped rockfish from Meadow Point to West Point and Alki Point (see Figure B-21, Appendix B). There were no other greenstriped rockfish documented in the WTD Existing Discharge Area.

Yellowtail Rockfish – *Sebastes flavidus*

Miller and Borton (1980) reported yellowtail rockfish near Meadow Point, offshore from Smith Cove, and north of Alki Point (west of Duwamish Head) (see Figure B-23, Appendix B). Adults of this species are commonly seen throughout the year in nearshore areas in the WTD Existing Discharges Area, including Elliott Bay (J. Christiansen, Seattle Aquarium, pers. comm.).

Quillback Rockfish – *Sebastes maliger*

Miller and Borton (1980) reported quillback rockfish from Meadow Point to West Point, Elliott Bay, and Alki Point (see Figure B-24, Appendix B). During 1975-76 beach seine and otter trawl surveys, 84 quillback rockfish were caught off West Point at depths between 25 and 95 m and 45 were caught off Alki Point at depths up to 70 m (Stober and Pierson 1984). One quillback rockfish was caught in eelgrass off Alki Point during 1976-77 beach seine surveys and several were seen near Piers 91 and 90 in Elliott Bay during diving transects (Stober and Pierson 1984). WDFW found quillback rockfish throughout the WTD Existing Discharges Area, including Elliott Bay, during video and trawl surveys (Figure 4-8 and Appendix C). Quillback rockfish were found in relatively shallow waters (less than 24 m) in nearshore areas.

Black Rockfish – *Sebastes melanops*

Miller and Borton (1980) reported black rockfish from Meadow Point to north of West Point, north of Smith Cove, and Elliott Bay (see Figure B-25, Appendix B). Stober and Pierson (1984) observed a single black rockfish near the surface during diving transects off the end of Pier 91 in Elliott Bay. There were no other reports of black rockfish in the WTD Existing Discharges Area.

Bocaccio – *Sebastes paucispinus*

Miller and Borton (1980) reported bocaccio near Meadow Point and north of Alki Point (west of Duwamish Head) (see Figure B-29, Appendix B). There were no other reports of bocaccio in the WTD Existing Discharges Area. This is an open water species with adults preferring deep waters (73-300 m) and is seldom seen in either video or trawl surveys (Hart 1980). However, waters within the WTD

Existing Discharges Area provide the necessary habitat for this species and it is possible that bocaccio occur in this area.

Canary Rockfish – *Sebastes pinniger*

Miller and Borton (1980) reported canary rockfish near Shilshole Bay in the northern portion of the WTD Existing Discharges Area (see Figure B-30, Appendix B). However, this species was not found in the WDFW video and trawl surveys and is rarely seen south of Hood Canal. This species is primarily found along the outer coasts and in the Straits (J. Christiansen, Seattle Aquarium, pers. comm.). In addition, surveying is difficult because this is mainly a deep, open water species (Hart 1980).

Redstripe Rockfish – *Sebastes proriger*

Miller and Borton (1980) reported redstripe rockfish near Meadow Point and in Elliott Bay (see Figure B-31, Appendix B). During 1975-76 otter trawl surveys, two redstripe rockfish were caught off West Point at depths of 45 and 70 m and fifteen were caught off Alki Point at a depth of 45 m (Stober and Pierson 1984). There were no other documented reports of redstripe rockfish in the WTD Existing Discharges Area.

Yelloweye Rockfish – *Sebastes ruberrimus*

Miller and Borton (1980) reported yelloweye rockfish near Meadow Point, West Point, Smith Cove, and the northeast side of Elliott Bay (see Figure B-32, Appendix B). This species is occasionally seen in the WTD Existing Discharges Area in deeper waters (greater than 25 m) (J. Christiansen, Seattle Aquarium, pers. comm.).

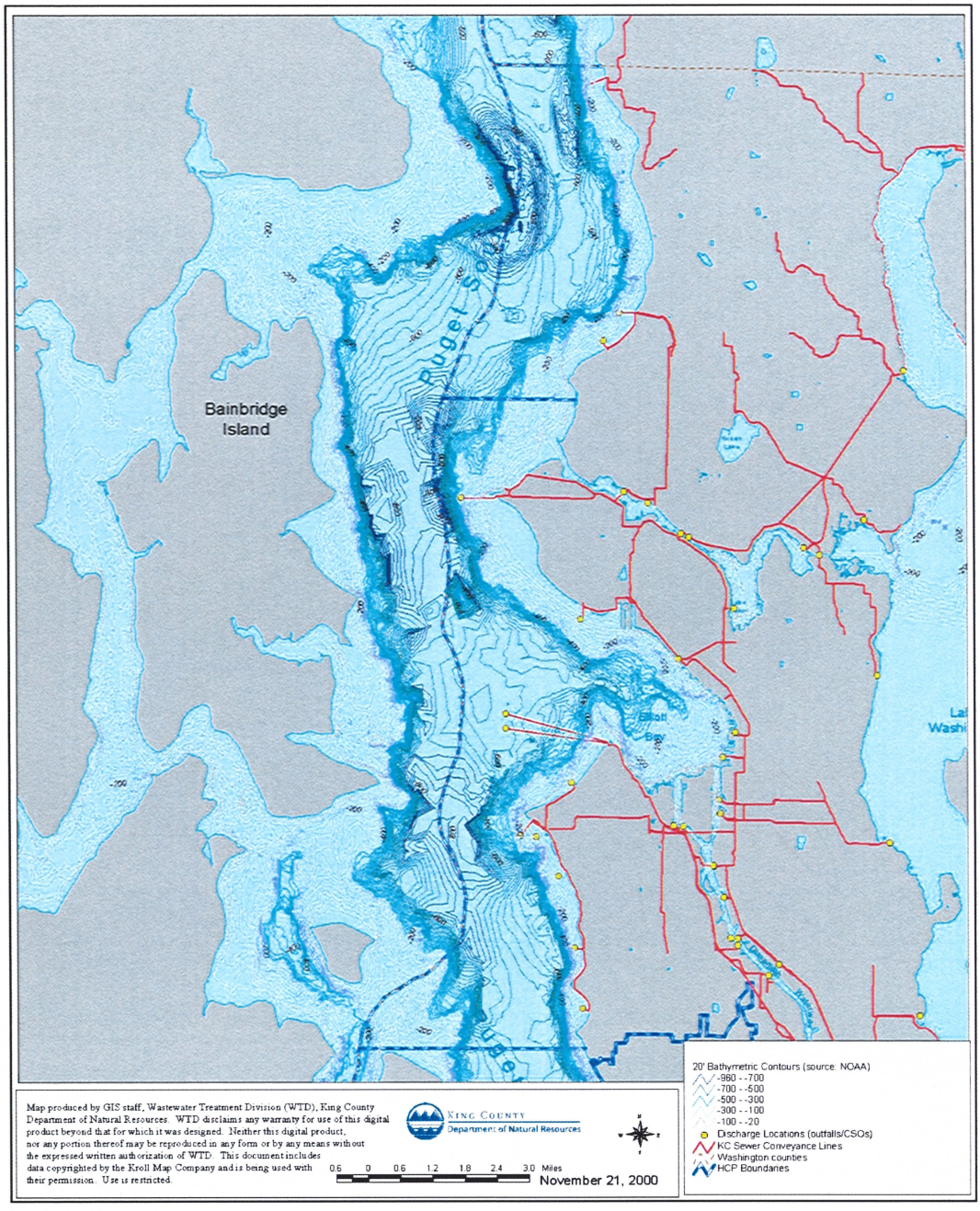

Figure 4-1. Bathymetric contours in the Brightwater Outfall Siting Area

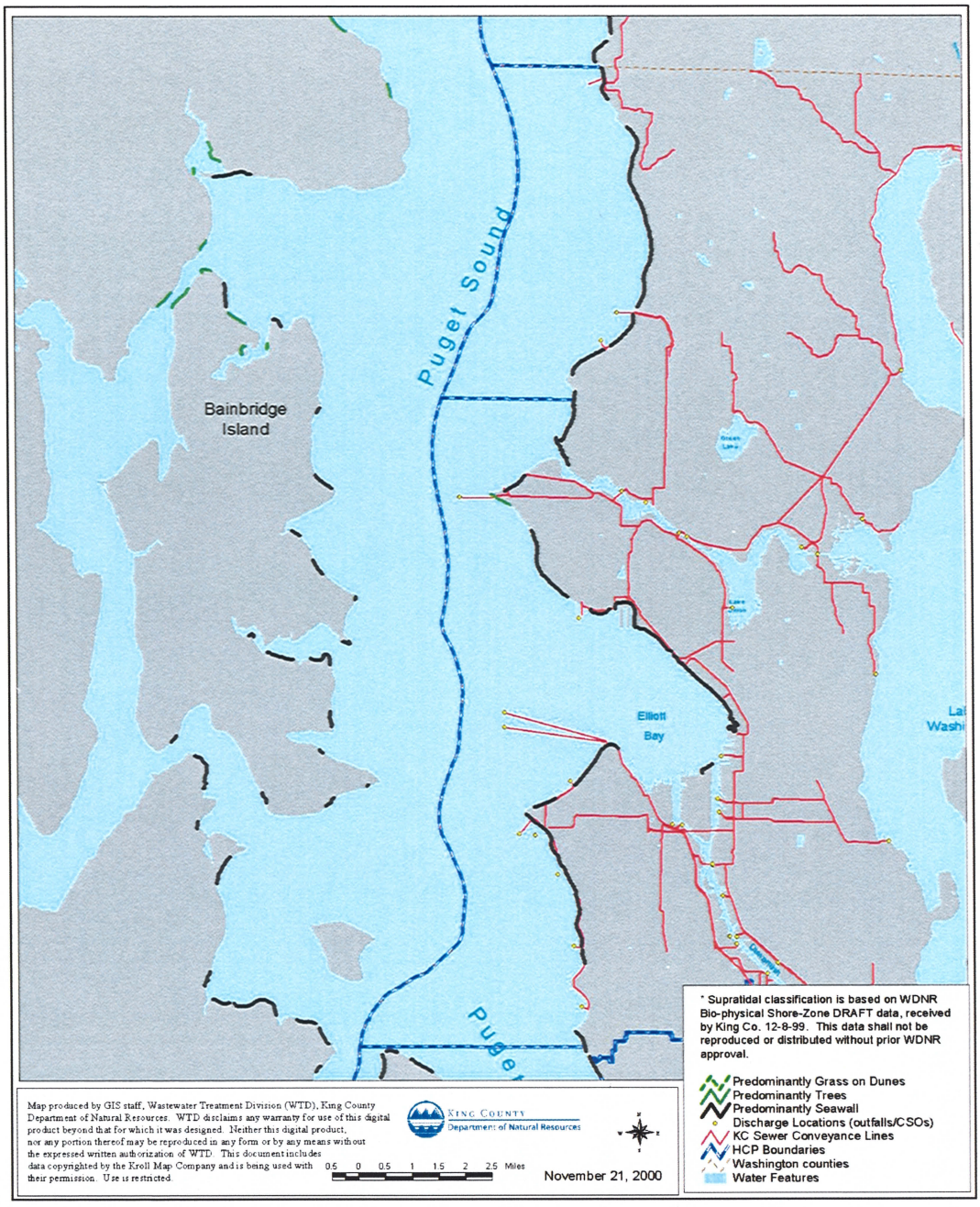

Figure 4-2. Supralittoral zone in the WTD Existing Discharges

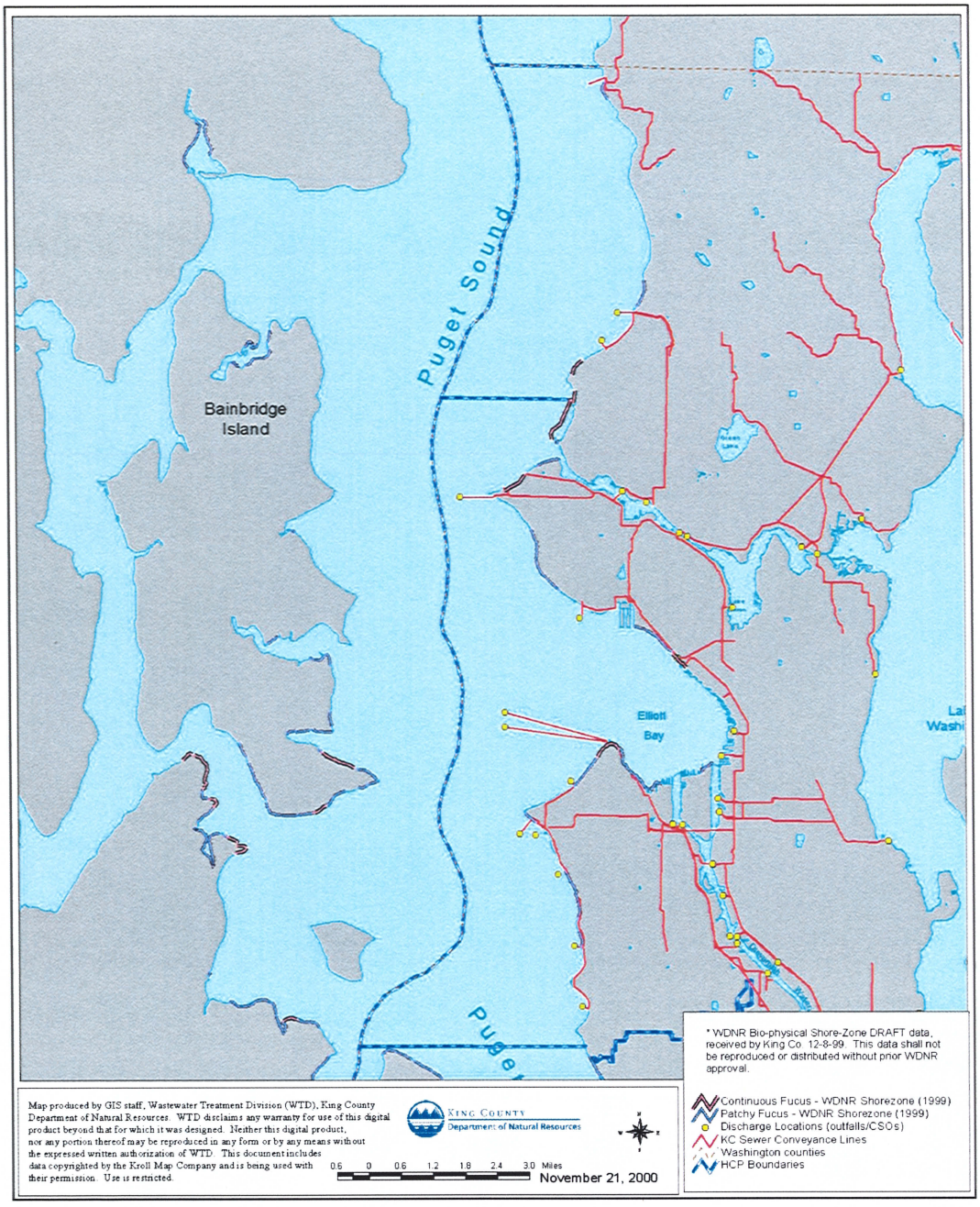

Figure 4-3. Distributions of rockweed (*Fucus*) in the intertidal zone of the WTD Existing Discharges Area

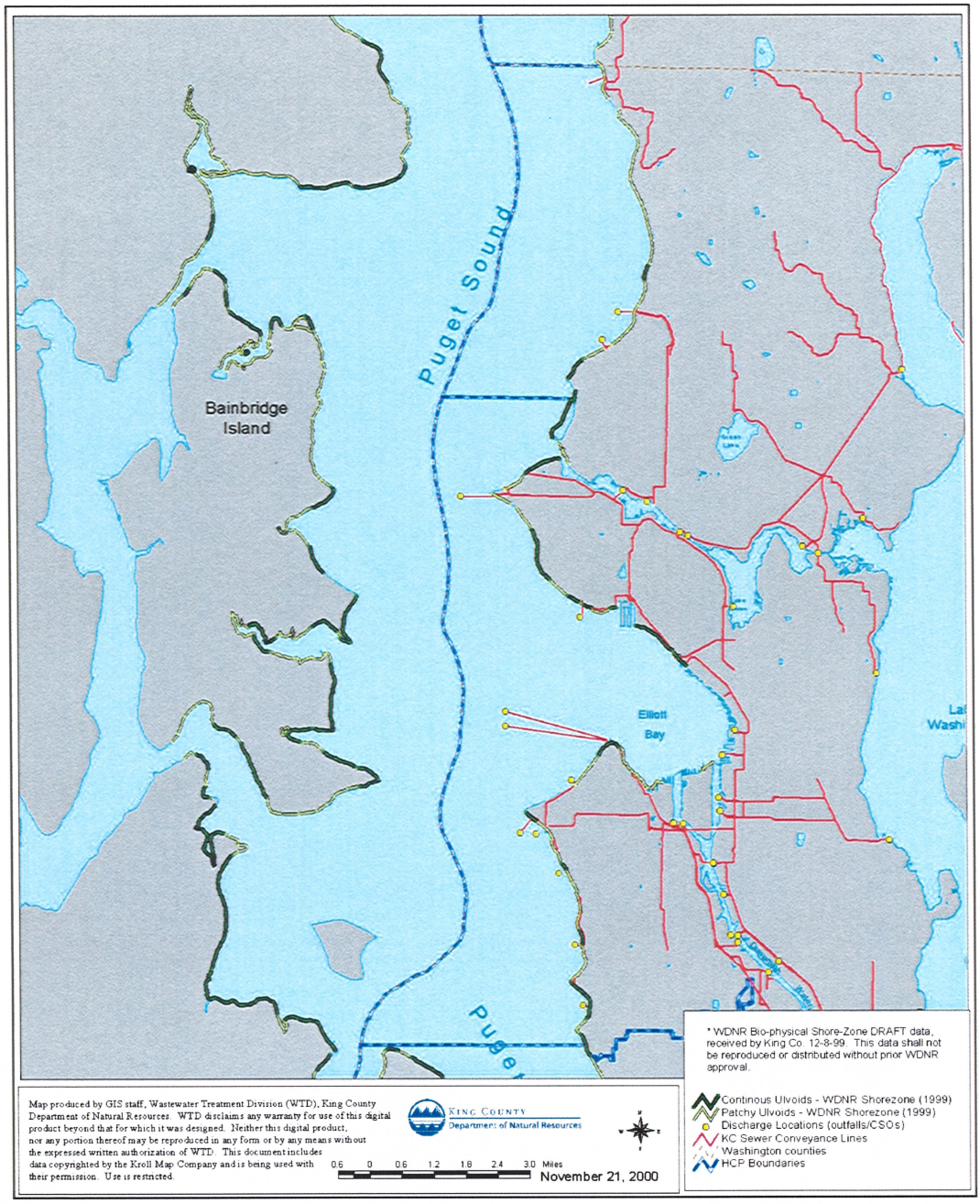

Figure 4-4. Distributions of Ulvoids in the intertidal zone through the shallow subtidal zone of the WTD Existing Discharges Area

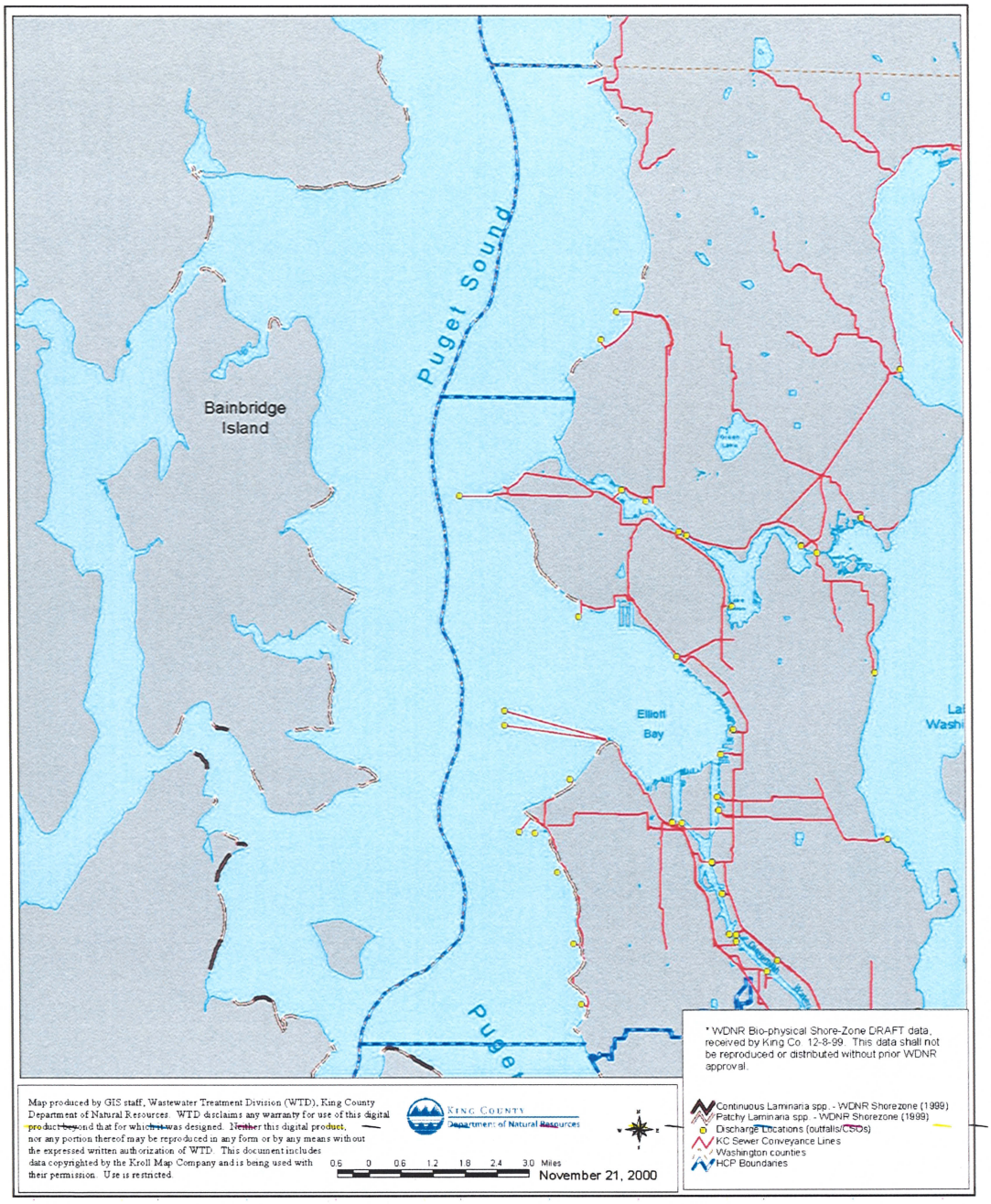

Figure 4-5. Distributions of *Laminaria* spp. in the intertidal zone through the shallow subtidal zone of the WTD Existing Discharges Area

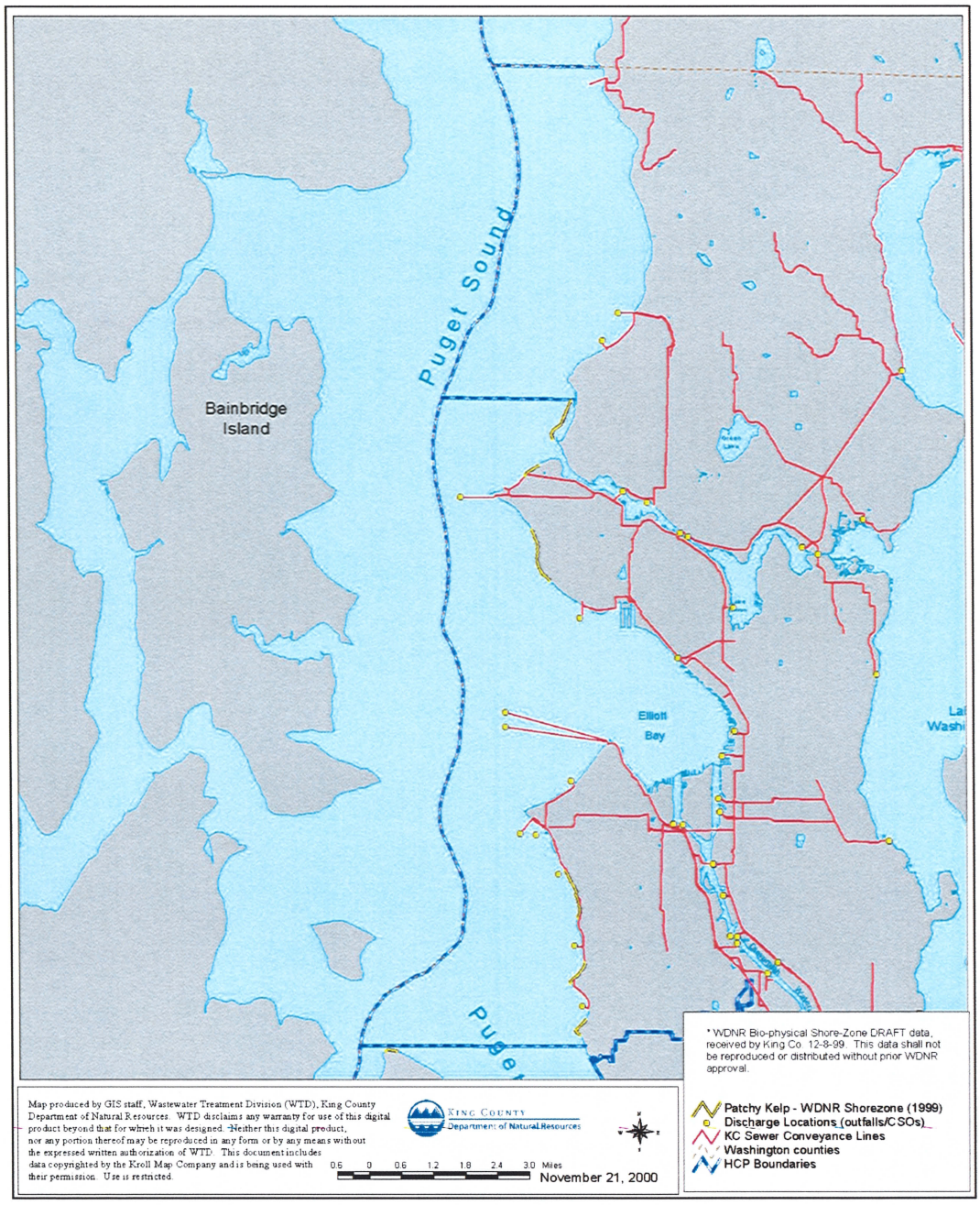

Figure 4-6. Distributions of kelp (*Nereocystis luetkeana)* in the intertidal zone through the shallow subtidal zone of the WTD Existing Discharges Area

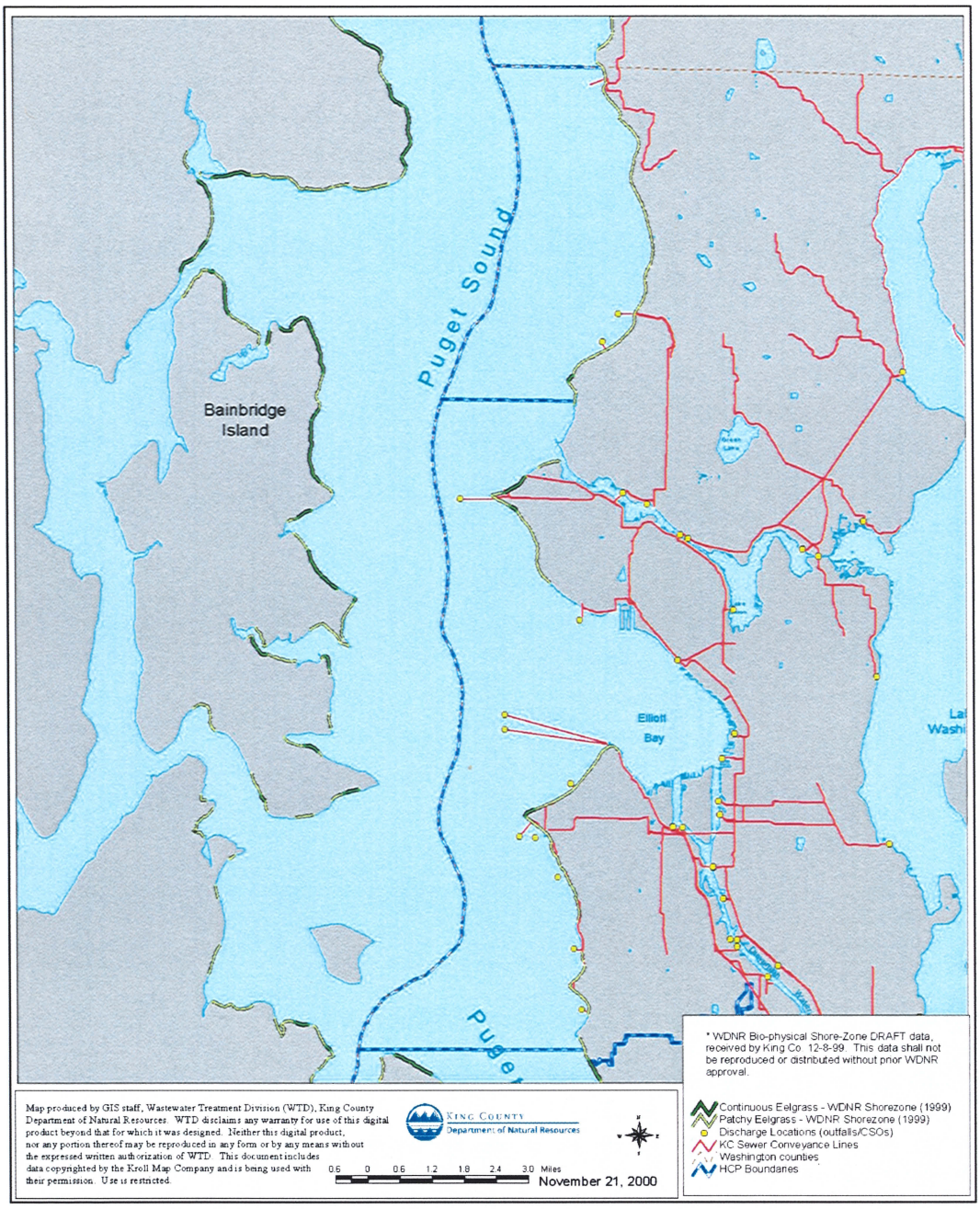

Figure 4-7. Distributions of eelgrass (*Zostera marina*) in the intertidal zone through the shallow subtidal zone of the WTD Existing Discharges Area

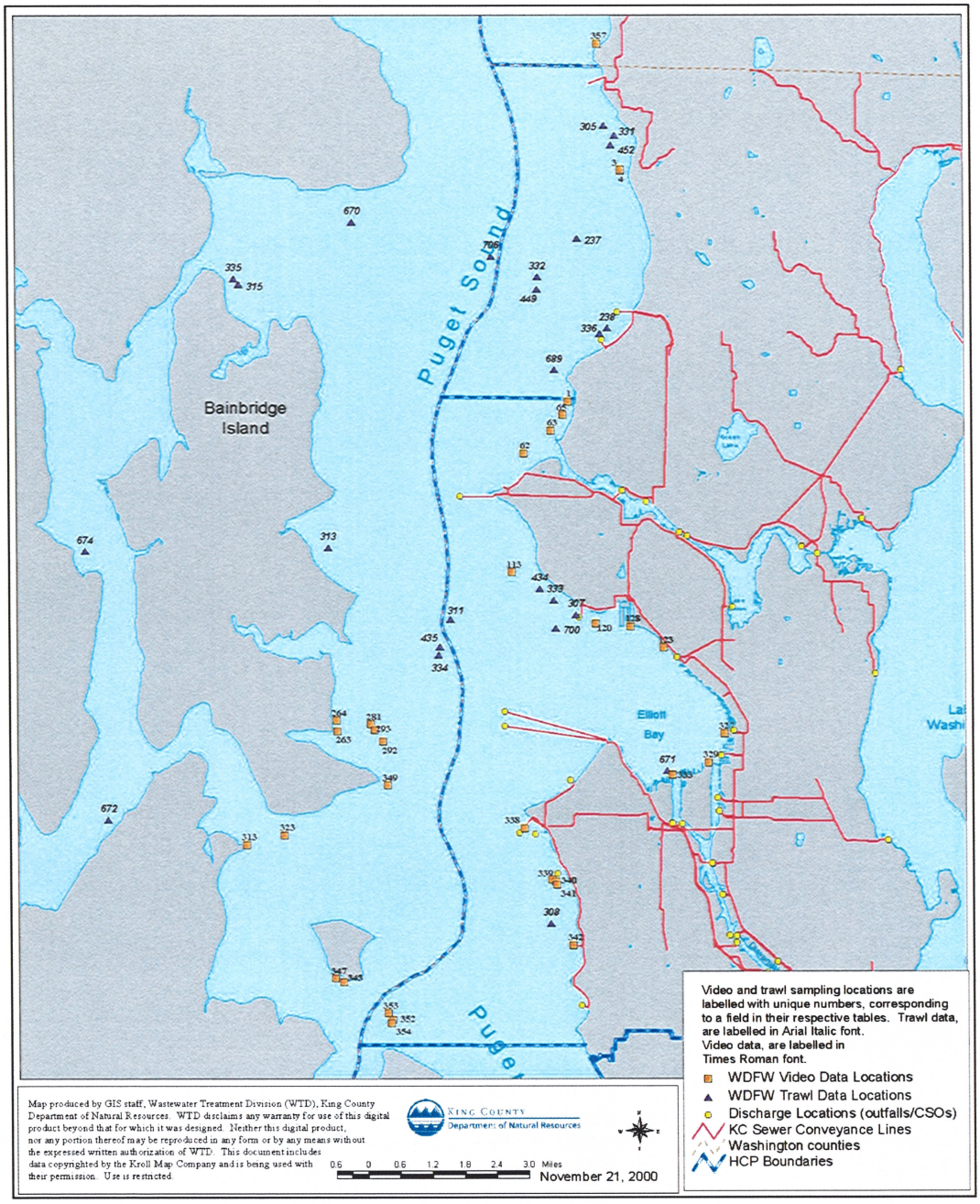

Figure 4-8. WDFW trawl and video marine fish data in the WTD Existing Discharges Area. See Appendix C for fish species noted at each location.

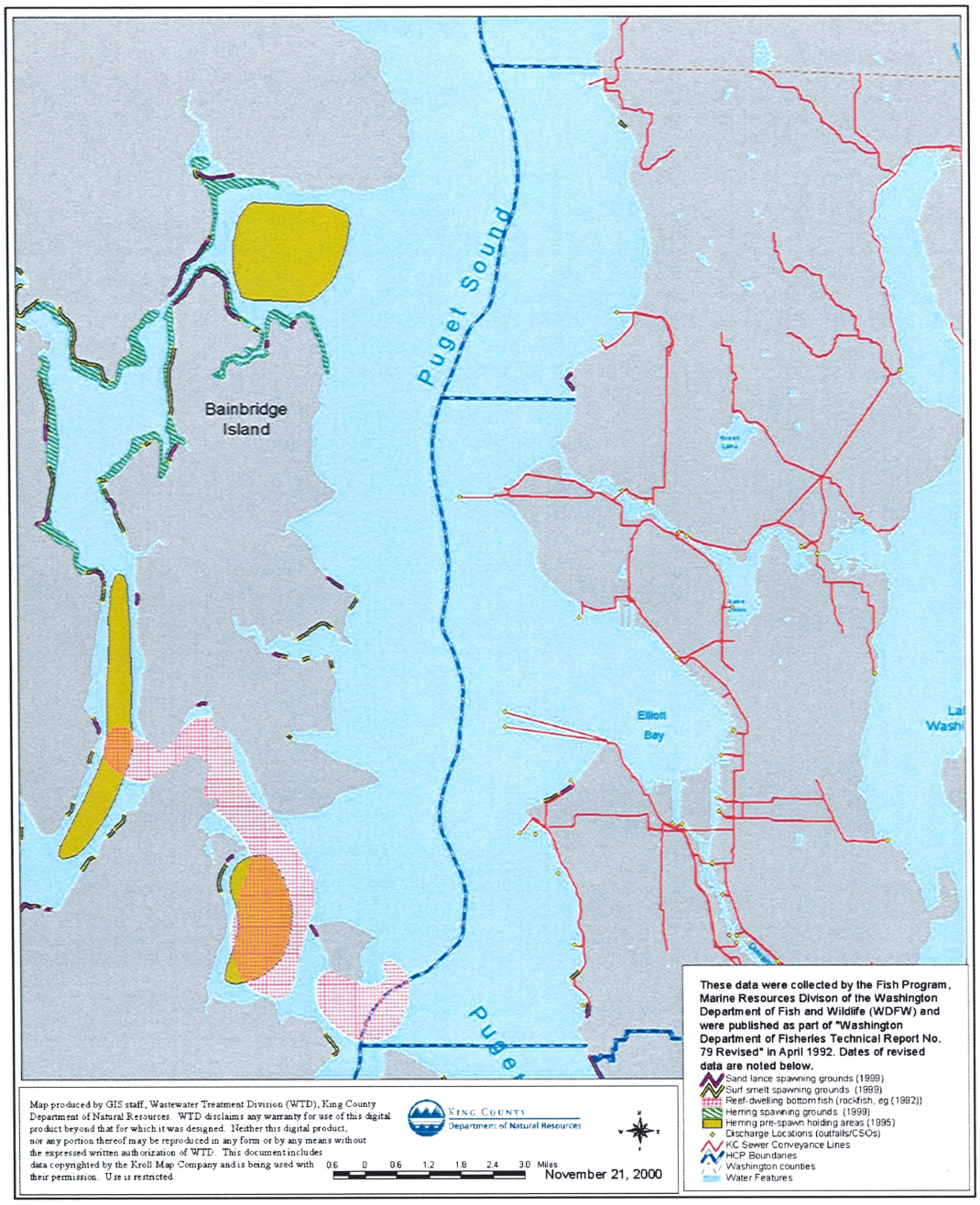

Figure 4-9. Forage fish spawning and holding areas and bottom fish/reef-dwelling habitats in the WTD Existing Discharges Area

Table 4-1. Marine fish species observed in the WTD Existing Discharges Area.[1]

Common Name	Genus species	Distribution	Primary habitat	Depth range (ft)	Average density (ind/m^2)	Relative abundance[2]
Green Sturgeon	*Acipenser medirostris*	none observed	NA	NA	NA	NA
White Sturgeon	*Acipenser transmontanus*	none observed	NA	NA	NA	NA
Pacific Cod (S & C P.S.)	*Gadus macrocephalus*	N & offshore from Meadow Pt, Meadow Pt, N & offshore from Smith Cove, between Alki Pt & Pt Williams	NA	30->360	0.0002[a]	7
Walleye Pollock (S. P.S.)	*Theragra chalcogramma*	S of Pt Wells, offshore between Pt Wells & Meadow Pt, Meadow Pt, offshore from mouth of Elliott Bay, W of Smith Cove, between Alki Pt & Pt Williams	NA	126->360	0.003[a]	9
Pacific Hake (C P.S.)	*Merluccius productus*	S of Pt Wells, N & offshore from Meadow Pt, offshore from mouth of Elliott Bay, between Alki Pt & Pt Williams	NA	126->360	0.003[a]	11
Lingcod	*Ophiodon elongatus*	S of Pt Wells, Meadow Pt, between West Pt & Smith Cove, N & S sides of Elliott Bay	hard, high relief structures on mud or mud/shell bottom	43-52	0.047[b]	6
Pacific Herring	*Clupea harengus pallasi*	S of Pt Wells, Meadow Pt, N of Smith Cove, S side of Elliott Bay	NA	30-360	0.0002[a]	4
Sand Lance	*Ammodytes hexapterus*	Spawning grounds (1 Nov to 15 Feb): Meadow Pt, N side of Alki Pt, between Pt Williams & Pt Brace	sand gravel beaches for spawning	upper inter-tidal	NA	probably abundant during spawning
Unidentified Baitfish	*Herring or Sand Lance*	between Pt Wells & Meadow Pt	NA	NA	NA	2

Table 4-1. Marine fish species observed in the WTD Existing Discharges Area.[1]

Common Name	Genus species	Distribution	Primary habitat	Depth range (ft)	Average density (ind/m^2)	Relative abundance[2]
Surf Smelt	*Hypomesus pretiosus*	Spawning grounds (mostly fall and winter in this area): S of Pt Wells, N side of Alki Pt, N side of Pt Williams, between Pt Williams & Brace Pt	very coarse sand to pea gravel beaches for spawning	upper inter-tidal		none observed during surveys, probably abundant during spawning
Eulachon	*Thaleichthys pacificus*	none observed	NA	NA	NA	NA
Brown Rockfish	*Sebastes auriculatus*	N of West Pt, between West Pt & Smith Cove, E & S sides of Elliott Bay, Alki Pt, S of Alki Pt	boulders on mud or mud/shell bottom	45-85	0.0986[b]	8
Copper Rockfish	*Sebastes caurinus*	S of Pt Wells, Meadow Pt, between Meadow Pt & West Pt, N of Smith Cove, Alki Pt, S of Alki Pt, N of Pt Williams, N of Pt Vashon	boulders	21-79	0.0915[b]	12
Greenstriped Rockfish	*Sebastes elongatus*	none observed	NA	NA	NA	NA
Widow Rockfish	*Sebastes entomelus*	none observed	NA	NA	NA	NA
Yellowtail Rockfish	*Sebastes flavidus*	none observed	NA	NA	NA	NA
Quillback Rockfish	*Sebastes maliger*	S of Pt Wells, Meadow Pt, N side of West Pt, between West Pt & Smith Cove, S side of Elliott Bay, S side of Alki Pt, S of Alki Pt, between Alki Pt & Pt Williams, N of Pt Vashon	boulders and artificial structures	29-79	0.416[b]	23
Black Rockfish	*Sebastes melanops*	none observed	NA	NA	NA	NA
Blue Rockfish	*Sebastes mystinus*	none observed	NA	NA	NA	NA

Table 4-1. Marine fish species observed in the WTD Existing Discharges Area.[1]

Common Name	Genus species	Distribution	Primary habitat	Depth range (ft)	Average density (ind/m^2)	Relative abundance[2]
China Rockfish	*Sebastes nebulosus*	none observed	NA	NA	NA	NA
Tiger Rockfish	*Sebastes nigrocinctus*	none observed	NA	NA	NA	NA
Bocaccio	*Sebastes paucispinus*	none observed	NA	NA	NA	NA
Canary Rockfish	*Sebastes pinniger*	none observed	NA	NA	NA	NA
Redstripe Rockfish	*Sebastes proriger*	none observed	NA	NA	NA	NA
Yelloweye Rockfish	*Sebastes ruberrimus*	none observed	NA	NA	NA	NA
Unidentified Rockfish	*Sebastes spp.*	S of Pt Wells, Meadow Pt, between Meadow Pt & West Pt, Smith Cove, N of Pt Williams	artificial structures	18-69	NA	7

NA - Not Available

[1]Based on data from Tech Report 79, Battelle, and WDFW.

[2]Relative abundance indicates the number of times a given species was observed during the surveys.

[a]Based on WDFW trawl surveys (Palsson data).

[b]Based on WDFW video surveys (Palsson data).